

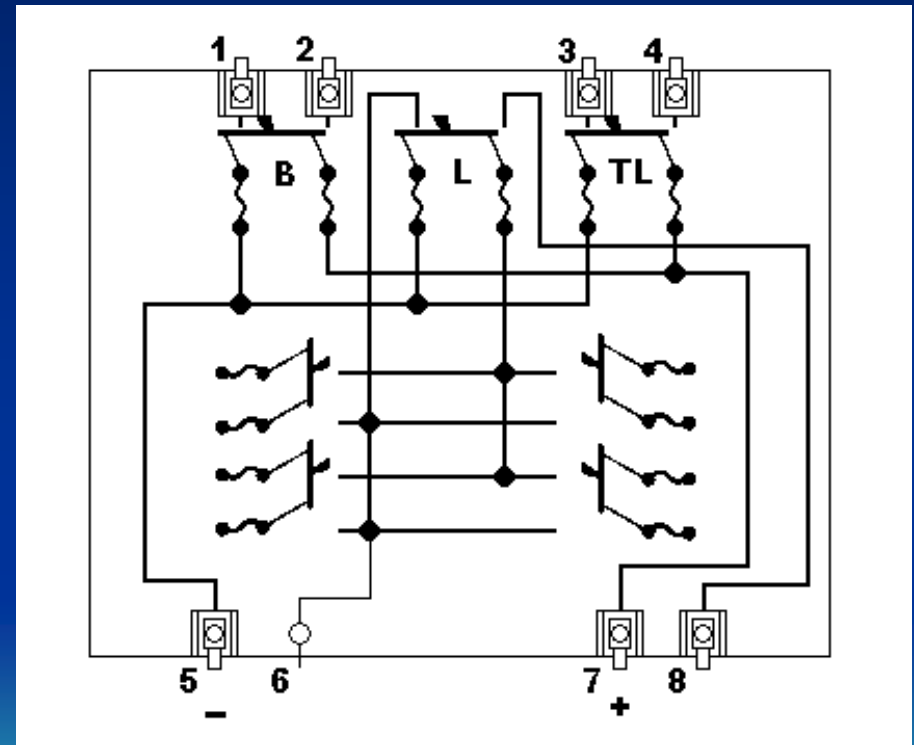
# Safety Electrical Equipment

Seminar 242



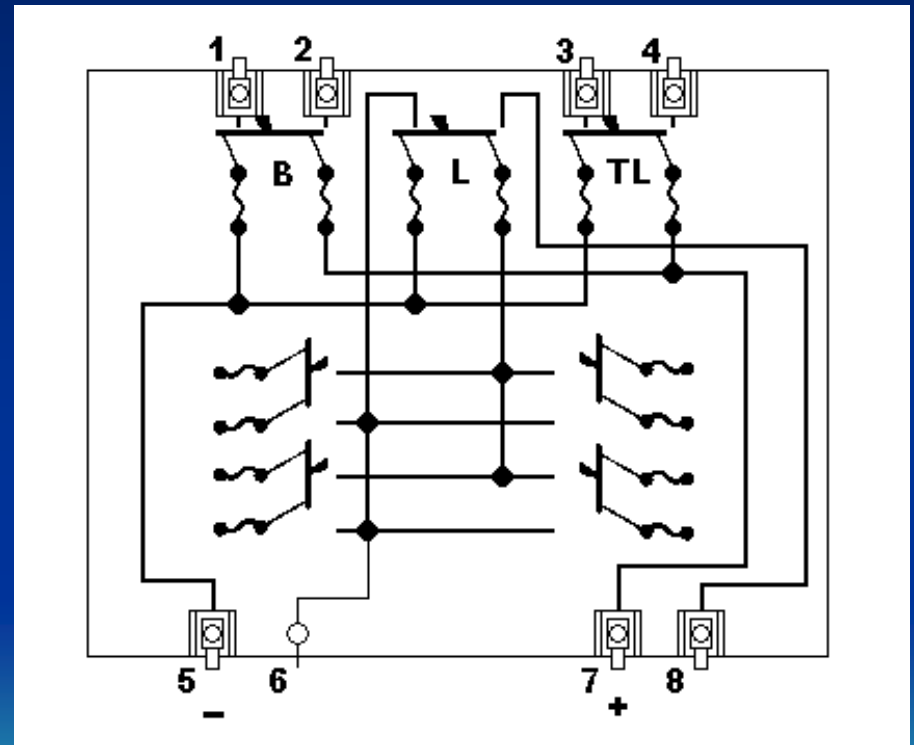
# Main Bus

- The heart of the electrical system
- Look for Battery, Lighting, & Train Line switches and fuses
- Often on same panel as lighting switches and fuses
- Everything else connects to this



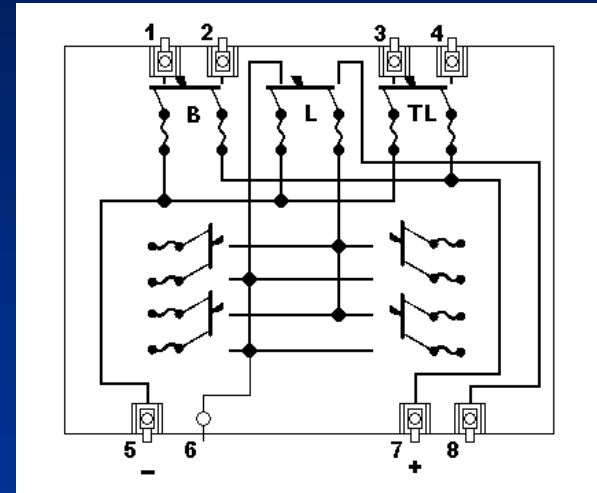
# Main Bus

- Rule of thumb:  
Positive is on the right. (“Are you positive it’s right?”)



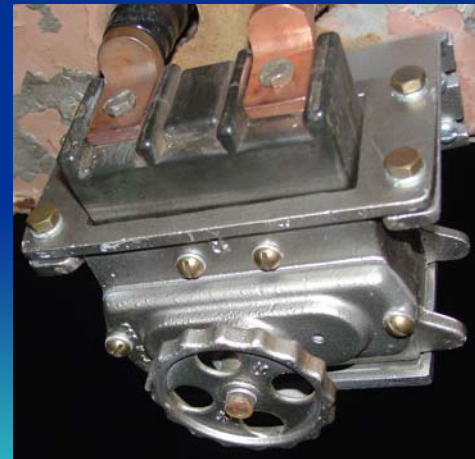
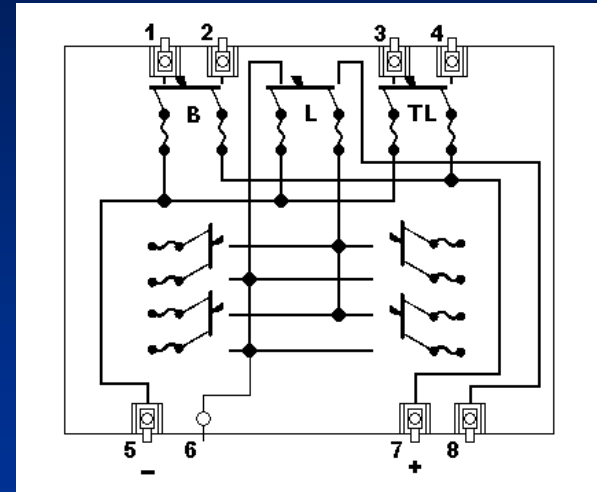
# Batteries

- Typically wet-plate lead & sulfuric acid
- Charge when generator is spinning
- (Bus voltage higher than batteries)
- Standby power for lights, blowers and starting engines



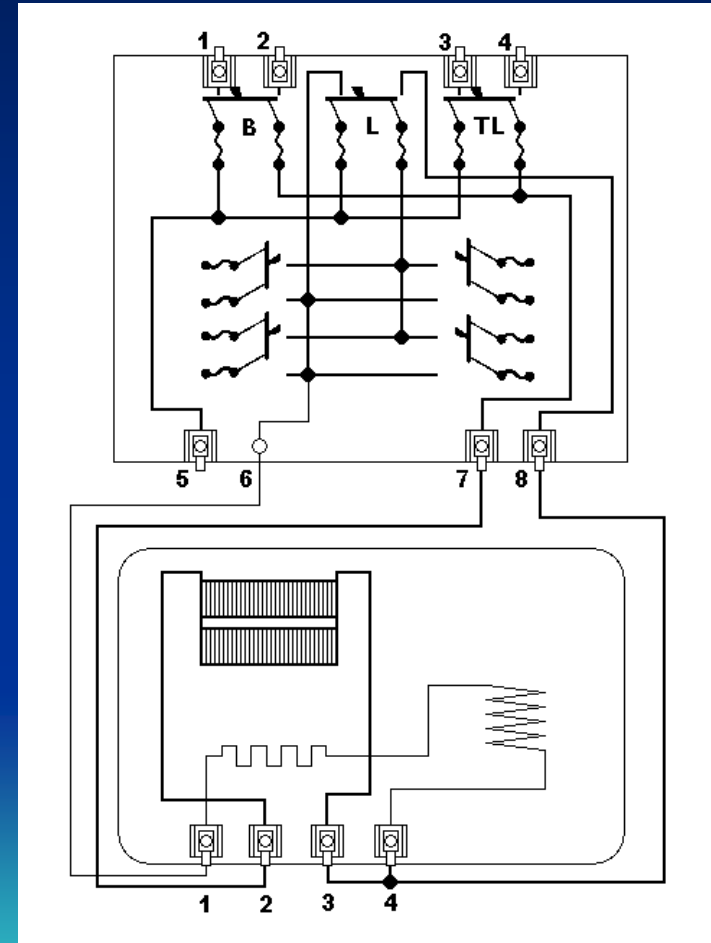
# Train Line

- Used to 'jump' one ailing car off another
- Batteries of ailing car may not charge (due to voltage drop)
- Only connect cars of the same voltage!
- (Cars will be roughly 32, 64, or 112 volts)



# Lighting

- Lighting and other loads are on the lighting main switch
- Carbon-pile load regulators keep the voltage just below battery voltage



# Load Regulators

- 350-, 700- and 1050-watt versions
- Coil in parallel with load – feels same voltage
- Pile(s) are in series with both load and coil – control voltage

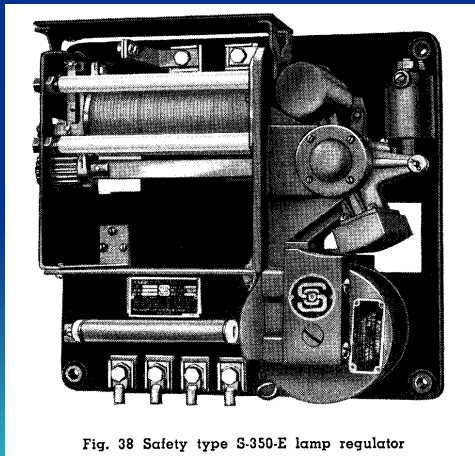


Fig. 38 Safety type S-350-E lamp regulator

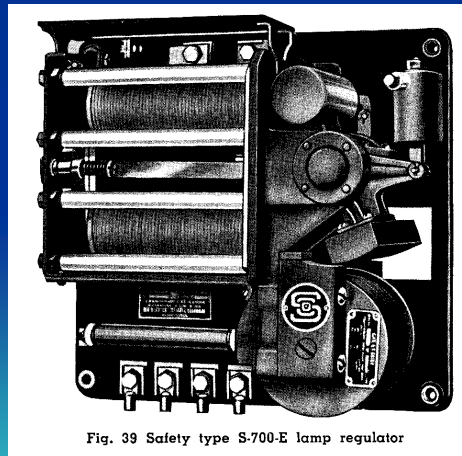


Fig. 39 Safety type S-700-E lamp regulator

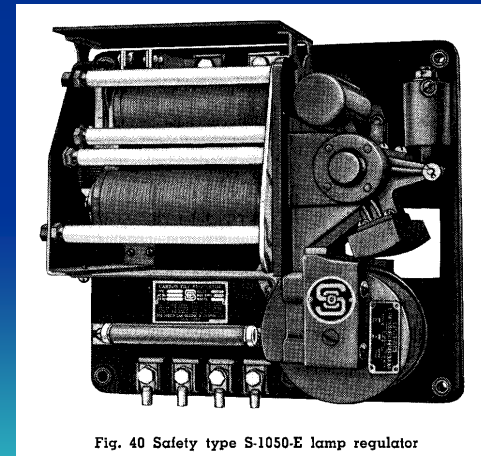


Fig. 40 Safety type S-1050-E lamp regulator

# Generators - 10kw or Less

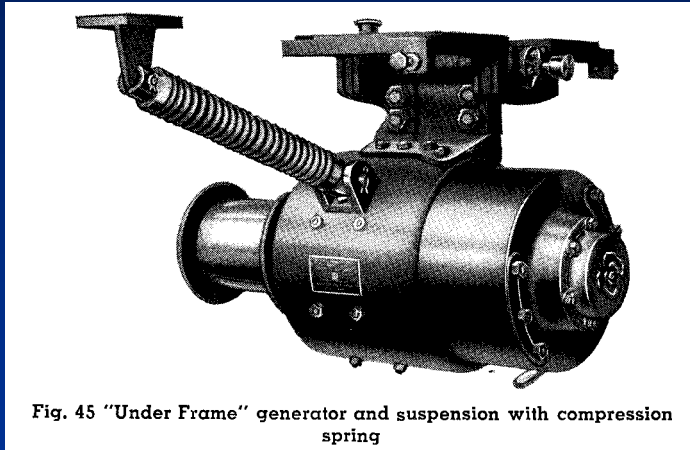


Fig. 45 "Under Frame" generator and suspension with compression spring

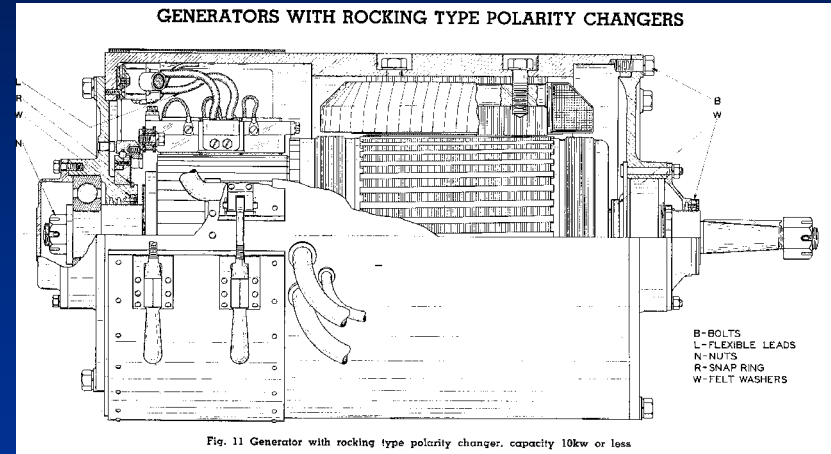
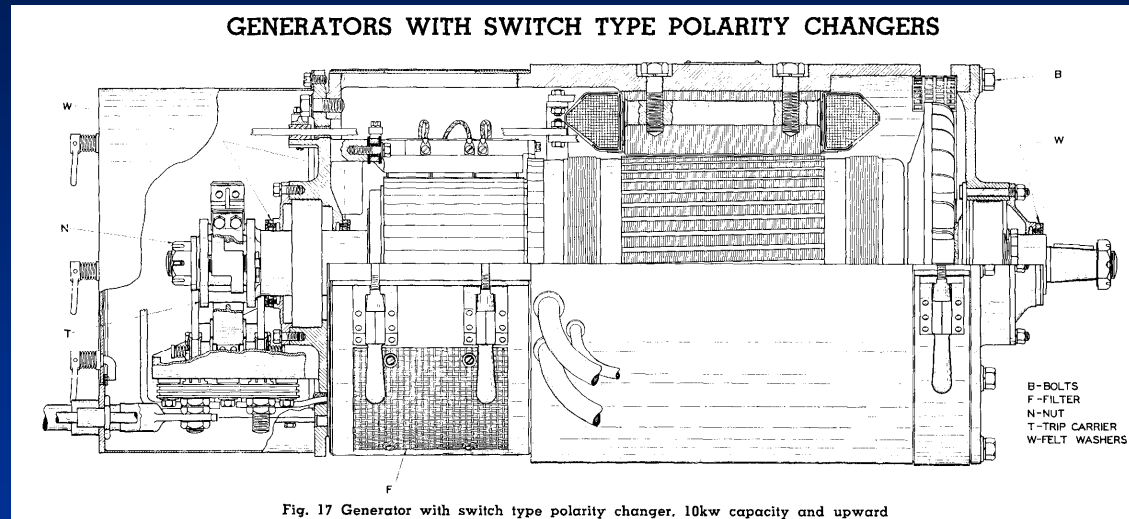


Fig. 11 Generator with rocking type polarity changer, capacity 10kw or less

- Axle-driven via flat belt or v-belts
- Brushes 'rock' so polarity doesn't change
- Max voltage 25% higher than batteries
- Actual voltage controlled by field windings

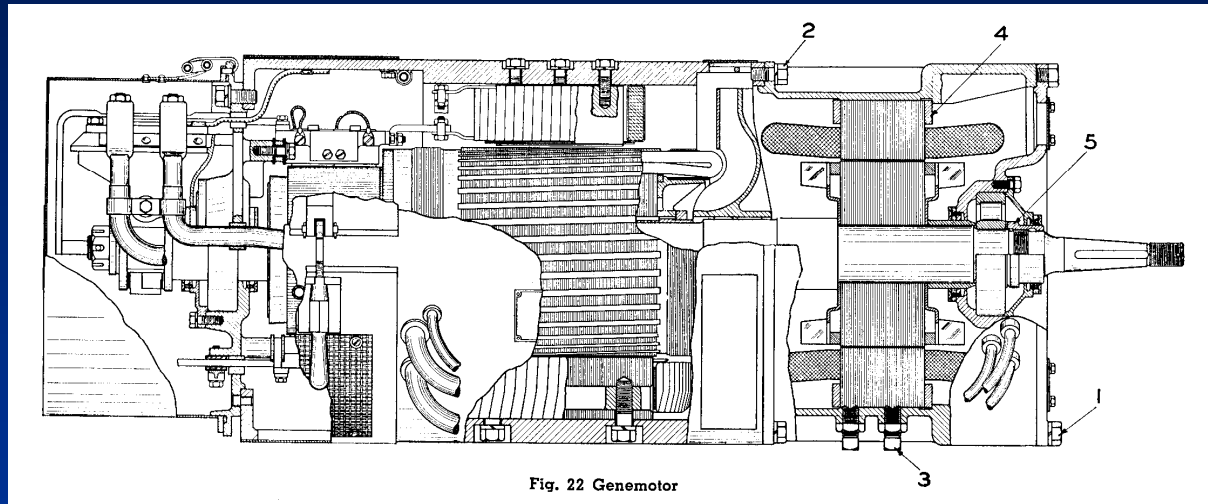


# Generators – 10kw or More



- Driven via gearbox and propeller shaft
- Polarity switch moves to match direction of travel
- Same output voltage regulation
- Usually parallel to car under center sill

# Genemotors – 10kw or More



- Very similar to high-capacity generators
- Includes a 208 $\Delta$  3 $\emptyset$  motor for standby power
- Includes a clutch in the drive train

# Generator Regulator

- Sized to match generator output
- Carbon pile(s) regulate strength of generator field windings (“excitation”)
- Handle lead-acid or nickel-iron batteries

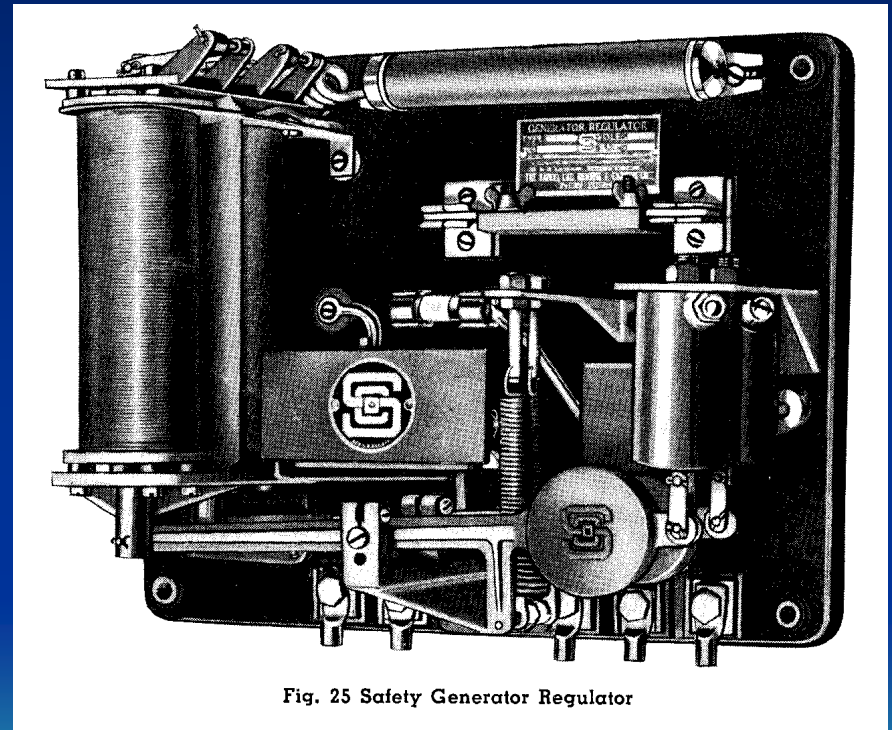


Fig. 25 Safety Generator Regulator

# Reverse Current Relay

- Keeps batteries from spinning generator until they're dead
- (Like a big diode)
- Back contacts prove whether the generator is generating or not
- For small generators, can share panel with generator regulator

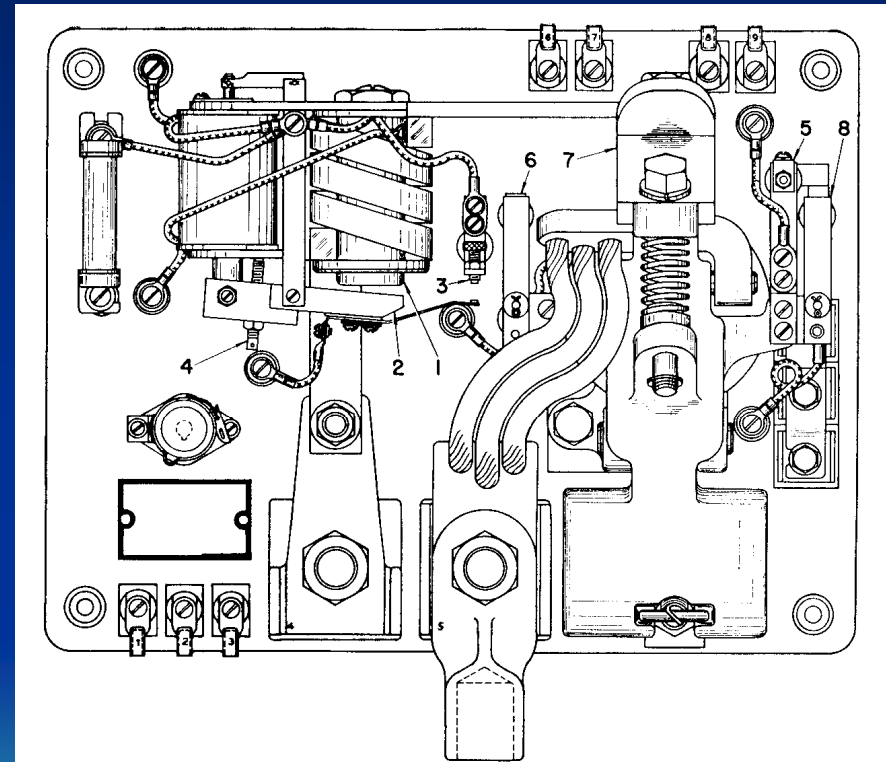


Fig. 37 Safety type S-31-EADRT Relay

# Generator Circuit

- Generator connected to generator regulator
- Regulator connected to reverse current relay
- Relay connected directly to main bus
- (Relay eliminates need for manual switch)

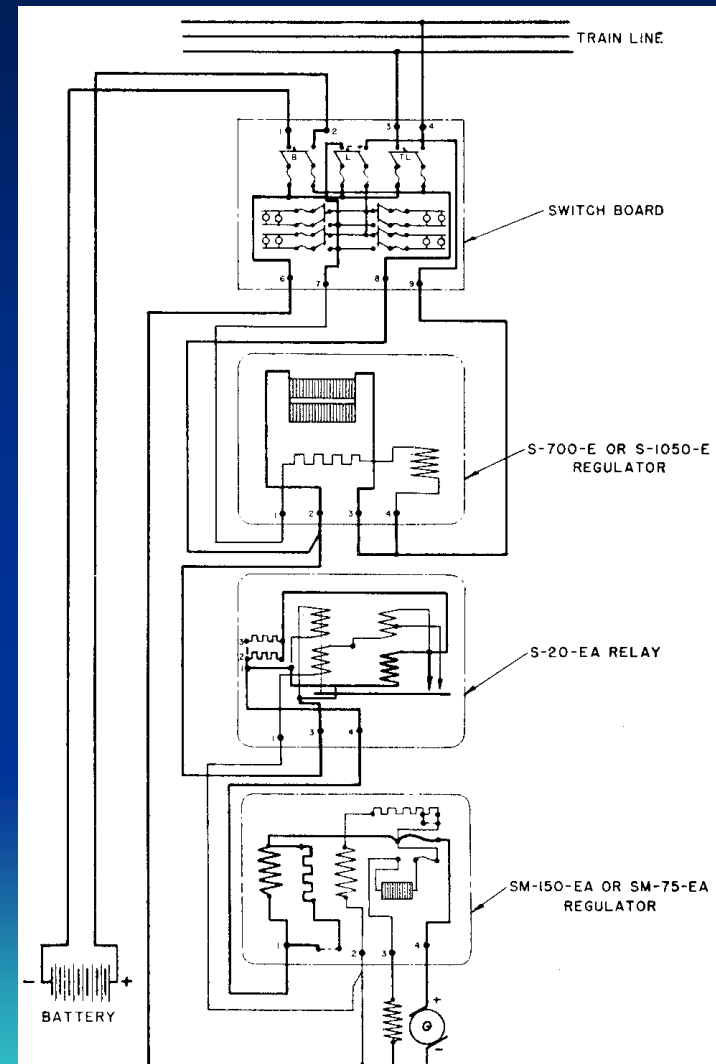


Fig. 33 Wiring diagram of type SM panels and type C switchboards

# Start via Residual Magnetism

- Note: no power to generator regulator when generator starts to spin
- Hence no power to field windings!
- Generator “should” have enough residual magnetism to self-excite a little bit

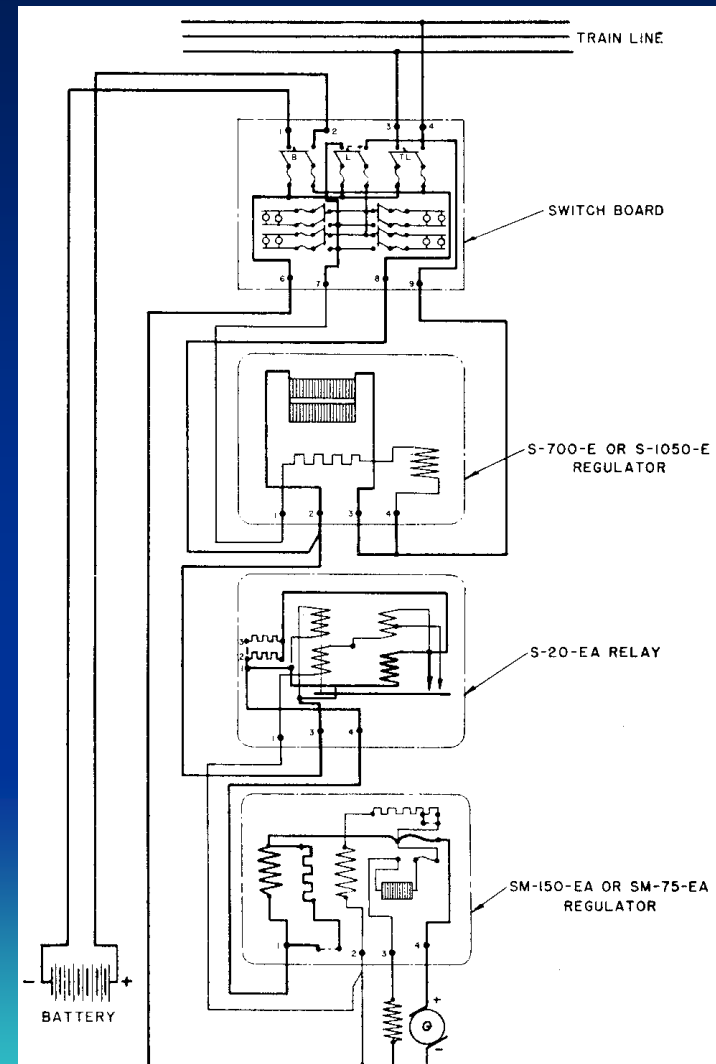


Fig. 33 Wiring diagram of type SM panels and type C switchboards

# Shore Power via Genemotor

- Up to 100 amps 208Δ 3Ø from shore
- Uses 60- or 100-amp Pyle-National Quelarc® connector
- Power pins are longer and connect first
- (Nothing happens – motor starter not picked)

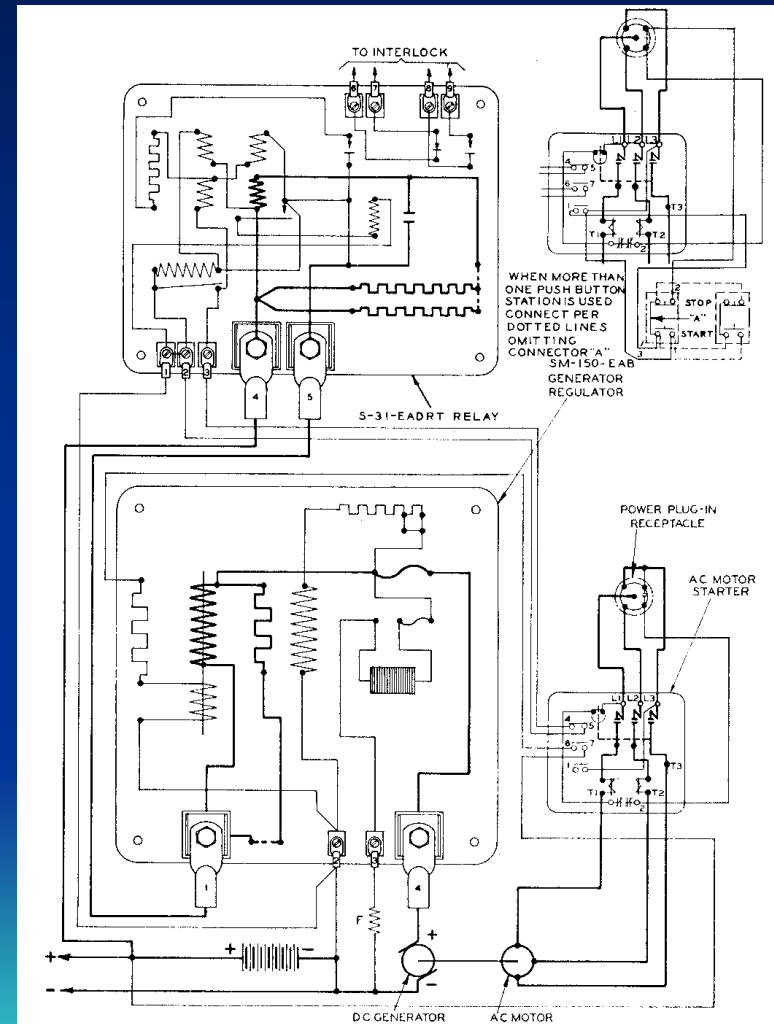


Fig. 35 Wiring diagram of genemotor equipment using SM-150-EAB regulator and S-31-EADRT relay

# Shore Power via Genemotor

- 4<sup>th</sup> contact is short and split in half
- After power connects, dummy contact in plug bridges shorter 4<sup>th</sup> pin, picking the motor starter relay
- (Do NOT use a cord where the 4<sup>th</sup> pin is neutral or ground!)

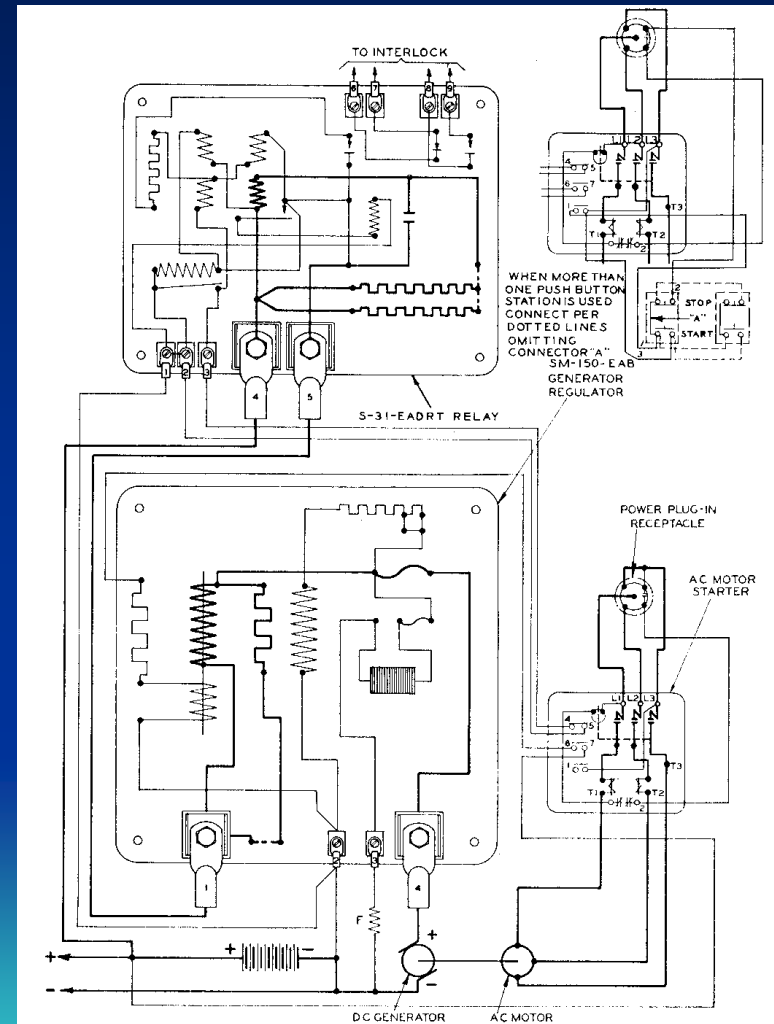


Fig. 35 Wiring diagram of genemotor equipment using SM-150-EAB regulator and S-31-EADRT relay



# Special Shore Power Mode

- Motor starter auxiliary contacts enable special operation
- Regulator and reverse current relay allow for extra-low generator output
- Reverse current relay pick delays, allowing generator to spool up

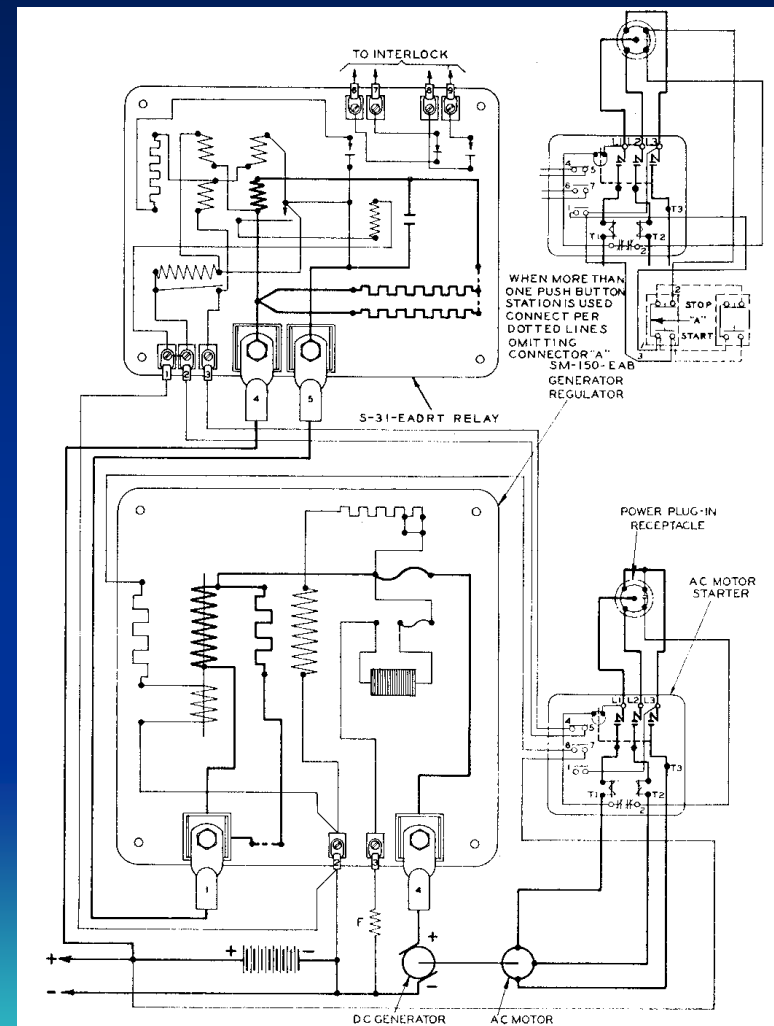


Fig. 35 Wiring diagram of genemotor equipment using SM-150-EAB regulator and S-31-EADRT relay

# What's that other stuff?

- Expect a heating control panel (Vapor) and possibly an A/C control panel (Vapor, Frigidaire, Trane, Waukesha)
- Engine-driven generators (Waukesha, Stadco) require start/stop controls and fault protection. Some have automatic startup & shutdown.



# What's that other stuff?

- Without fluorescent lighting, there will probably be a small “buzz box” to make 120vac for electric shavers.
- For fluorescent lighting, expect a motor-generator and a step-starter panel.



# What's that other stuff?

- Various fuses or circuit breakers for water coolers, ventilation fans, A/C and refrigeration pumps.
- Spare fuses and bulbs.
- Storage space for the train-line connector cable.
- Maintenance records.



# Appendix: Standard Voltages

Lighting	Battery Output	Battery Charging	Generator Rated For
31	32	38	40
62	64	76	80
110	112	132	140

# Appendix: Benefits of DC

- Multiple power sources can be hooked together without special equipment.
- (Multiple AC sources must be synchronized, or bad things will happen.)
- DC power is easily stored in batteries.



# Appendix: Benefits of AC

- Voltage is easily changed via a transformer.
- AC is easily turned into DC via a rectifier.
- All lights with ballasts (fluorescent, metal-halide, sodium vapor, mercury vapor) require AC to operate.
- Most commercial appliances (think Kitchen and Restroom) require AC.
- Better suited to central power plant designs.



# That'll Do



- (Discussion?)